

Chapter Four

Comprehensive Source-Separation

Composting Programs

Overview

Our case-study communities with comprehensive source-separation composting programs are diverting significant amounts of organic materials from disposal facilities. Most of the communities recovering more than 30 percent of their municipal solid waste (MSW) are composting at least 11 percent of their waste. While 28 of the 30 communities studied have some type of composting program, some are more comprehensive than others. Communities with composting rates greater than 11 percent typically provide frequent and convenient collection, target a wide range of organic materials, serve a high percentage of households, and offer incentives to encourage composting. Set-out and collection methods, composting techniques, and marketing strategies vary widely among communities. By comparing the operating experience of these communities, this chapter discusses program features that help to maximize recovery of organic materials, one of the largest components of the municipal waste stream. The first section of this chapter details collection, processing, and marketing strategies. The second describes policies implemented on a local level to increase composting levels. (See Table 2.1 for each community's municipal solid waste composting recovery rate.³)

Collection, Processing, and Marketing Strategies

Yard trimmings are a fairly homogeneous component of the waste stream that can be composted in residents' backyards, at community-scale composting sites, or in regional facilities. Food discards, another significant portion of the waste stream, can also be composted in residents' backyards or composted on a community level.

Finished compost serves as a soil amendment or mulch, improving the physical, chemical, and biological properties of soil. In the case-study communities with source-separation composting programs, the supply of and demand for compost are usually well-balanced. In some cases, demand exceeds supply.³

Communities with composting rates greater than 11 percent typically provide frequent and convenient collection, target a wide range of organic materials, serve a high percentage of households, and offer incentives to encourage composting.

Collection

Tables 4.1 and 4.2 describe yard trimming collection program characteristics during the base year of study, including program initiation year, curbside versus drop-off service, types of materials collected, and set-out and collection methods. During the base year two communities, Providence, Rhode Island and Peterborough, New Hampshire, did not have composting programs.

As indicated in Table 4.1, many communities are encouraging backyard composting and "don't bag it" programs to reduce yard waste collection and processing costs. Many of the listed communities report that a substantial number of residents are employing such techniques. For example, the City of West Linn, Oregon estimates that 15 to 20 percent of all yard debris generated in 1990 was composted in residents' yards. (See Chapter 3 for a discussion of backyard composting programs.)

Table 4.1
Yard Debris Collection Characteristics

Community	Year Data Applicable	Curbside Initiation Year	Yard Waste Mandate	Compost Program Initiation	Collection Strategies	Private/ Public Collection (a)	Materials Coll. at Curbside for Composting	Materials Coll. at Drop-off for Composting	Households Served w/ Curbside Collection	Percent of Total Households Served w/ Curbside Collection (b)	Percent of Households Served in Refuse District (c)	Pounds/ Household/ Month Recovered at Curbside (d)
Austin, TX	FY89	1988	None	1988	CS,DO,BY	Public/Pvt.	[L]	[L,GC,CT]	110,000	55	100	2.1
Berkeley, CA	FY91	1976	None	1989 (e)	CS,DO	Public	[L,GC,BR,CT]	[L,GC,BR,CT]	2,600	6	6	96.2
Berlin Township, NJ	1990	1976	SS, LB	1976	CS,DO	Public	L,GC,BR,WW,CT	L,GC,BR,WW,CT	1,800	100	100	216.6
Boulder, CO	1990	1989	None	1989	DO,BY	Public	[BR]	[CT]	NA	NA	--	NA
Bowdoinham, ME	FY90	--	None	1990	DO	--	--	[L,GC]	--	--	--	--
Columbia, MO	FY90	1988	None	pre-1965	CS,DO	Public	[CT]	[L,GC,CT]	18,500	72	100	NA
Dakota County, MN	1990	1989	LB, HR	1989	CS,DO,BY	Private	[L,GC,BR,CT]	[L,GC,BR,CT]	70,000	70	--	33.6
Fennimore, WI	1990	1989	SS, LB	1989	CS,DO,BY	Public	L	L,GC,FW	970	100	100	NA
King Co., WA	1990	Varies	None	NA	CS,DO,BY	Varies	[L,GC,BR,CT]	[L,GC,BR,WW,CT]	NA	NA	--	NA
La Crescent, MN	1990	1989	LB	1989	DO	Public	--	[L,GC,BR]	--	NA	--	--
Lafayette, LA	FY90	1990	None	1990	CS,DO	Contract	[L,GC,BR,CT]	[L,GC,BR,CT]	27,500	93	100	32.2 (f)
Lincoln, NE	1990	1988 (P)	None	1988	CS,DO	Contract	[L,GC,BR]	[L,GC,BR,CT]	2,000	3	4	31.0
Lincoln Park, NJ	1990	1976	SS (g)	1976	CS,DO	Public	L,GC,BR,CT	L,GC,BR,CT	2,772	65	65	85.6
Mecklenburg Co., NC	1990 (h)	--	None	1983 (h)	DO	Public	--	[L,GC,BR,WW]	--	--	--	--
Monroe, WI	1989	1981	SS	1981	CS,BY	Public	L,GC,BR,CT]	--	3,900	91	0	22.9
Naperville, IL	1990	1975	LB	1975	CS,BY	Public	L,GC,BR,CT	--	24,500	79	NA	33.3
Newark, NJ	1989	1986	SS, LB	1986	CS	Contract (i)	L,GC,BR,CT]	--	NA (i)	NA	NA	NA
Perkasie, PA	1990	1989	None	1989	CS	Public	[L,BR,CT]	--	3,500	90	100	31.1
Peterborough, NH	1990	--	None	1991 (j)	--	--	--	--	--	--	--	--
Philadelphia, PA	FY90	1978	SS	1978	CS,BY	Public	L, [CT]	--	45,000	7	28	NA
Portland, OR	1990	1973 (k)	None	1973	CS,DO,BY	Private	[L,GC,BR,CT,FW] (l)	[L,GC,BR,CT,FW]	NA	NA	0	NA
Providence, RI	1990	--	None	None	--	--	--	--	--	--	--	--
San Francisco, CA	1990	--	None	1988	DO,BY	--	--	[CT]	--	--	--	NA
Seattle, WA	1990	1989	SS	1989	CS,DO,BY	Contract	L,GC,BR,WW	L,GC,BR,WW	94,805	38	--	64.7
Sonoma Co., CA	1990	1990 (P)	None	1990	CS,DO	Private	[L,GC,BR,CT]	[CT]	1,200	1	NA	11.5
Takoma Park, MD	1990	1980	SS	1980	CS,BY	Public	L,GC, [CT]	--	4,100	58	100	49.0
Upper Township, NJ	1990	1972	SS, LB	1972	CS	Public	L, [GC,BR,WW,CT]	L, [GC,BR,WW,CT]	3,860	100	100	38.2
Wapakoneta, OH	9/89-8/90	>1970	LB	1971	CS,DO	Public	[L]	[BR,GC]	3,548	100	100	NA
West Linn, OR	1990	1985	HR	1985	CS,DO,BY	Private	[L,BR,CT]	[L,GC,BR,WW,CT]	5,300 (m)	86	86	0.1
West Palm Beach, FL	4/90-3/91	1990	None	1990	CS	Public	[L,GC,BR,WW,CT]	--	18,306	75	100	113.0

Key:

Materials enclosed in brackets [] are those for which set-out or drop-off is voluntary. Participation is mandatory for all other materials.

BR = Brush

BY = Backyard Composting

Coll. = Collection

CS = Curbside

CT = Christmas Trees

DO = Drop-off

FW = Food Waste

GC = Grass Clippings

HR = Hauler Requirement

L = Leaves

LB = Landfill Disposal Ban

NA = Not Available

P = Pilot programs represent cities serving less than 5 percent of their total residential households with curbside collection of yard debris.

SS = Residential Source-Separation

WW = Wood Waste

-- = Not Applicable

Notes:

- (a) Public -- City or County provides curbside or drop-off service; Private -- one or more private haulers provide service; Contract -- City or County contracts with one or more providers.
- (b) Percentage of total households serviced with curbside collection of yard waste.
- (c) Percentage of the households in jurisdiction's refuse collection district that are also served with yard waste collection.
- (d) Based on the number of households receiving municipal yard waste collection.
- (e) Berkeley began composting in 1978, however this program was discontinued and no composting occurred between September 1988 and August 1989. Composting was re-instituted in mid-1989; an estimated 3,000 tons of yard waste were composted in 1990.
- (f) Pounds recovered reflect tons collected over 5 months only, as Lafayette's program did not begin until May 1990.
- (g) The City banned the landfilling of yard waste in 1991, effective October 1992.
- (h) Because of the unrepresentative high volume of materials generated from Hurricane Hugo, yard waste tonnages used to calculate the composting rate are based on FY 1989 data. Program characteristics are 1990 data. Charlotte, located in Mecklenburg County, initiated a weekly yard waste curbside collection program in January 1991.
- (i) Newark's Office of Sanitation contracts with three private haulers to collect leaves from the residential sector. All households are served, as needed.
- (j) Prior to 1991, the Town burned all brush and wood waste brought to its drop-off center. It is now composting yard and wood waste delivered to the center.
- (k) Yard waste collection did not begin until 1987.
- (l) Sunflower Recycling, Inc., picks up food waste in 5-gallon buckets it provided to its 105 customers. Sunflower composts the food waste with sawdust.
- (m) Only an estimated 4 tons of the 1,552 tons composted in 1990 were collected at curbside by West Linn Disposal. While curbside service is offered to 5,300 households, it is rarely used. West Linn Disposal offers year-round, on-call collection of source-separated yard debris for a nominal charge: \$3.50 for each bag of leaves and \$7.50 for each bundle of brush. This is less than the charge for refuse collection, but more expensive than self-hauling yard waste to the composting site. As a result, most residents self-haul materials.

There are two ways to collect source-separated yard waste for composting at community-scale or regional sites curbside or drop-off.

Curbside Collection

Twenty-four of the 30 communities studied have curbside collection programs. However, some of these service only a limited number of households and/or provide only fall leaf or seasonal Christmas tree collection. To collect yard debris and trimmings, communities often utilize existing public works equipment such as front-end loaders, refuse packers, and dump trucks. Packer trucks have the advantage of compacting material, reducing the frequency of unloading. Some communities purchase new equipment such as vacuum leaf loaders. The loaders can either be hooked up to existing packer or dump trucks, or can be purchased as a self-contained truck and vacuum loader unit. Leaf loaders, used in conjunction with existing vehicles cost approximately \$10,000 to \$20,000 each; self-contained vacuum loaders cost approximately \$100,000. (See Chapter 8 for a discussion of how using existing equipment can reduce capital costs.)

Collection methods vary depending on the type and amount of yard materials collected. During the fall months of heavy leaf generation many communities collect leaves loose, using front-end loaders or vacuum attachments, to relieve residents of the task of bagging leaves. In northern cities, temporary crews are often hired or shifted from other departments to collect fall leaves. In Takoma Park, Maryland, for example, four five-person crews collect leaves in November and December; 10 crew members are temporary employees and 10 are assigned from the Streets and Parks Department. One worker drives the collection vehicle, one prepares leaves for vacuuming, one operates the vacuum, and two rake the leaves into the vacuum. Leaves are blown into a leaf collection box located behind the vacuum loader. In Monroe, Wisconsin, the Streets Department picks up fall leaves utilizing a retrofitted jeep with a push broom attached to the front. Drivers push leaves to street corners and a front-end loader scoops the material into a packer truck. Berlin Township switched from vacuum collection to front-end loader collection after designing a scoop--a 2-cubic-yard

Table 4.2
Curbside Set-out and Collection Method for Yard Debris

Community	Pick-up Frequency	Same Day Collection (a)	Collection Period	Set-out Method for Leaves	Set-out Method for Grass Clippings Brush, Wood Waste	Collection Vehicles	Number of Crew Members per Truck
Austin, TX	Weekly	Yes	Nov-Dec/Feb-Apr	Bagged (b)	--	Packer	3
Berkeley, CA	Semi-weekly	NA	Year-round	Bags or Cans	32-gal. Bags/64-gal. Cans	Packer	1
Berlin Township, NJ	Weekly	NA	Year-round	Loose	Cans or Bagged	Loader/Dump Truck	1-3
Boulder, CO	Once/year	NA	3 Weeks in Spring	--	Loose	Loader/Dump Trucks	NA
Bowdoinham, ME	--	--	--	--	--	--	--
Columbia, MO	Once/year	Yes	3 Weeks in January	--	--	--	--
Dakota County, MN	Weekly	Varies	Apr-Nov	Bagged or Loose	Bagged or Loose	Packer	--
Fennimore, WI	Varies (c)	NA	Varies (c)	Loose	Loose	Street Sweeper	2
King Co., WA	Varies (d)	--	Year-round	Cans or Toters	Cans, Toters, or Paper Bags	Packer	Varies
La Crescent, MN	--	--	--	--	--	--	--
Lafayette, LA	Weekly	Yes	Year-round	Bagged or Bundled	Bagged or Bundled	Packer	3
Lincoln, NE	Weekly	No	July-Nov	90-gallon Toter	90-gallon Toter	Packer	1
Lincoln Park, NJ	Semi-weekly	Varies	Apr-May, Oct-Nov	Bagged or Loose	Bagged or Loose	Vacuum/Dump Truck/Packer	2
Mecklenburg Co., NC	--	--	--	--	--	--	--
Monroe, WI	Weekly	Varies (e)	Seasonal (e)	Loose	Bagged	Broom/Loader/Packer	1
Naperville, IL	Weekly	NA	Apr-Nov	Loose	30-gallon Paper Bags	Vacuum/Leaf Loader	NA
Newark, NJ	Weekly	No	Oct-Jan	Bagged or Loose	Bagged or Loose	Loader/Packer/Dump Trucks	NA
Perkasie, PA	Weekly	NA	Oct-Nov	Loose	Bundled	Vacuum/Dump Truck	3-6
Peterborough, NH	--	--	--	--	--	--	--
Philadelphia, PA	Once/year	No	Nov-Dec	Loose	--	Leaf-loader/Vacuum/Trailer	Varies
Portland, OR	Weekly	NA	Nov-Apr	Bagged or Loose	Bagged or Loose	Packer	NA
Providence, RI	--	--	--	--	--	--	--
San Francisco, CA	--	--	--	--	--	--	--
Seattle, WA	Varies (f)	Yes	Year-round	Cans or Bagged	Cans, Bagged, or Bundled	Packer	1
Sonoma Co., CA	Weekly	No	Year-round	90-gallon Cans	90-gallon Containers	Packer	1-2
Takoma Park, MD	Weekly	No	Year-round	Loose	Cans or Bagged	Packer or Vacuum w/ box	3 or 5
Upper Township, NJ	Weekly	NA	Year-round/Seas.	Bagged & Loose (g)	Cans, Bagged, or Bundled	Packer Truck/Dump Truck	2 or 3
Wapakoneta, OH	NA	NA	Nov-Dec	Loose	--	Vacuum/Dump Truck	NA
West Linn, OR	On-call	--	Year-round	Bagged	Bundled	Pick-up Truck	1
West Palm Beach, FL	Semi-weekly (h)	Yes	Year-round	Bagged or Loose	Bagged or Loose	Crane/Packer	3 (i)

Key:

NA = Not Available

Semi-weekly = Every other week

-- = Not Applicable

Notes:

(a) Same day as refuse collection

(b) In 1991 Austin began collecting leaves loose at curbside. Residents can also drop off leaves and grass clippings at Austin Community Gardens, a nonprofit horticultural organization.

(c) The City picks up leaves two to three times during the fall season. Brush and wood waste, picked up monthly, year-round, are burned.

(d) Yard waste collection frequency varies from weekly to monthly.

(e) Grass clippings are collected weekly, on the same day as refuse collection, from April until Nov. Leaves are collected weekly, October 15 until Thanksgiving Day, not on refuse days.

(f) In the North Section, leaves are collected weekly, year-round; in the South Section leaves are collected bi-weekly from March through October and monthly the rest of the year.

(g) Bagged grass clippings and leaves are collected year-round and loose leaves are collected in November and December.

(h) In 1991 the City purchased a one-person-operated crane and began to collect yard waste weekly.

(i) Two people operate a crane truck and a third driver follows in a compactor.

container with the end cut out—to attach to the rear of the refuse vehicle. The Recycling Coordinator claims this scoop enables the crew to collect 50 percent more leaves in a day than with the vacuum loader.

Case-study communities with year-round collection of yard trimmings usually request residents to place trimmings in cans or in plastic or paper bags. Crews generally collect bagged materials in packer trucks. Plastic bags are not accepted in Naperville, King County, and Takoma

Park because of problems associated with debagging the yard materials. The City of Monroe recommends that yard debris be placed in transparent plastic bags to ensure that residents separate yard waste from refuse.

West Palm Beach, Florida collects yard debris year-round using an alternative method. Fine-toothed loaders shaped like clamshells are attached to cranes. The loaders pick up both bagged and loose yard trimmings at the curb and dump the material into compactor trucks.

How Berlin Township, New Jersey and Seattle, Washington Achieve High Composting Levels

Berlin Township, a suburban community with primarily single-family residences, is prohibited by State law from landfilling leaves. The Pinelands Commission, a State-run board with jurisdiction over a protected area that encompasses part of Berlin Township, bans the landfilling of grass clippings. While Berlin Township currently has approval to compost only leaves at this site, it is applying for a permit to compost additional materials there. These legislative measures have prompted the Township to implement a comprehensive yard trimmings collection program. Berlin Township provides weekly, year-round curbside collection for four types of yard waste: leaves, grass clippings, wood waste, and brush from all of its households. Additionally, it collects and chips Christmas trees. Residents and businesses may also drop off materials free of charge at the regional composting facility located in the Township. In addition to weekly residential pick-up, workers collect loose leaves at curbside twice per month on average during November and December with a retrofitted scoop, a front-end loader, and a compactor truck. Loose leaves are also collected in April. In 1990, the Township composted 39 percent of its residential waste.

Seattle has one of the best materials recovery programs in the country. In order to meet its 1998 goal of 60 percent municipal solid waste recovery, Seattle plans to compost 99 percent of its residential yard waste (excluding self-haul waste) and 93 percent of yard waste self-hauled by residents and businesses. By 1991 Seattle was composting 95 percent of the 42,726 tons of residential yard waste generated and 90 percent of self-haul yard waste. Since 1989 source separation of yard waste has been mandatory for City residents receiving curbside collection of refuse. In addition, the City's volume-based refuse rate provides a direct incentive to source separate yard waste. The City's contracted waste haulers collect leaves, grass clippings, and brush at curbside. The north section receives year-round collection; the south section receives twice monthly collection from March through October and monthly collection during the rest of the year. Residents without curbside refuse service self-haul yard waste (as they do refuse) to the City's two transfer stations. Residents are charged \$4 per carload of yard waste and \$5 per carload of mixed refuse. Yard waste is composted at the Cedar Groves Compost Facility, a 26-acre site located 30 miles southeast of Seattle. Material is shredded with a tub grinder and then formed into piles. Finished compost sells for \$6 per cubic yard to wholesalers; retailers and wholesale outlets sell the compost in 1-cubic-foot bags for approximately \$3 per bag. Since 1986 Seattle has also implemented a successful backyard composting program that has served as a model for communities around the country. In 1990 Seattle composted 14 percent of its residential waste.

A study conducted in Bristol, Connecticut found that collecting bagged leaves requires less time and is more cost-effective than collecting loose leaves using a front-end loader.⁴ However, our data indicate that both methods are cost-effective when large amounts of material are recovered. Therefore, communities might consider utilizing a set-out and collection method that maximizes resident participation in the program. (Chapter 8 provides a full discussion of the costs of composting collection and processing.)

In communities that provide curbside refuse collection, curbside yard waste collection is needed to divert large-volume materials (such as fall leaves and spring and summer grass clippings), but drop-off programs can play a crucial role in capturing additional organic waste off-season.

Drop-off Collection

Drop-off collection of yard debris can be practical and cost-effective. In rural and smaller communities, particularly in those where residents self-haul refuse, drop-off programs have recovered significant amounts of yard waste. In communities that provide curbside refuse collection, curbside yard waste collection is needed to divert large-volume materials (such as fall leaves and spring and summer grass clippings), but drop-off programs can play a crucial role in capturing additional organic waste off-season. Mobile drop off centers can serve several municipalities on a rotating basis. These sites may also provide the only opportunity for private businesses such as landscapers to divert their yard trimmings from disposal. Communities can provide residents and private haulers maximum incentive to deliver their yard debris to drop-off sites by locating these at disposal facilities and accepting source-separated yard waste free of charge or at a reduced tipping fee. Volume-based refuse rates can also encourage residents to use drop-off sites.

The rural community of Bowdoinham, Maine, for example, has a yard debris drop-off site at the landfill, where two-thirds of the residents self-haul refuse for disposal. Residents pay volume-based rates to drop off refuse and no fee to drop off yard trimmings. In fiscal year 1990, Bowdoinham diverted 11 percent of its MSW through composting leaves and grass clippings at this site.

Although residents in West Linn, Oregon can receive curbside yard waste collection, they pay a lower fee (\$0.50 per bag of leaves and \$3 per cubic yard of brush) to drop off yard waste at the drop off center than to have it collected at curbside (\$3.50 for each bag of leaves and \$7.50 for each bundle of brush). The City composted 21 percent of its municipal waste in 1990. Only an estimated 4 of the 1,552 tons composted were collected at curbside.

Processing and Marketing Strategies

Communities compost yard debris using a variety of techniques some requiring little or no maintenance, others requiring more intensive intervention. Each system has its own advantages and disadvantages. Instead of composting yard trimmings, communities may choose to grind them for a mulch product or spread them directly on agricultural land. Table 4.3 compares some of these methods. The amount of residual material (including plastic and other noncompostable materials) rejected from composting or mulching sites utilized by our communities is generally low, from 0 to 2 percent by weight. West Palm Beach, Florida reported a very high reject rate of 26 percent in 1990, which it attributed to careless set-out and collection methods.⁵ The City was not required to pay a tipping fee at the mulch site that year and did not actively remind residents to keep refuse out of yard materials.

Finished compost or mulch is given away to residents free of charge in 13 communities and sold in 12 communities. Through the sale of compost or mulch end products, communities can recoup some of the costs associated with yard debris collection and processing. Selling compost or mulch end products also emphasizes to residents and landscapers the value of such material. (Table 4.4 lists the compost and mulch end products and per ton revenues.)

Many of the rural communities that compost their yard debris use low-technology systems, which require less intervention, and are thus generally less expensive. However, materials take longer to compost in low-technology systems, and a lack of adequate oxygen in the compost pile can result in the generation of malodorous compounds. Turning a pile more frequently can reduce odor problems.⁶ In addition, because yard debris and/or finished compost is often not screened or ground in low-technology systems, the finished product may not be as uniform as that produced with other methods. Low-technology composting systems are often used in communities that have secluded composting sites, much available land, limited available capital equipment and labor, and little or no intention of selling the finished product. All the communities studied that processed yard trimmings using low-technology methods, including Takoma Park, Bowdoinham, La Crescent, and Monroe, did not sell the finished compost but allowed residents to take it free of charge.

Through the sale of compost or mulch end products, communities can recoup some of the costs associated with yard waste collection and processing. West Linn, Oregon earned \$16,000 in 1989 from the sale of compost products.

Of the communities studied, fifteen compost yard debris in windrows (elongated piles) using a medium level of technology. Contaminants (such as plastic and paper) are removed, and material may be screened or ground prior to forming into windrows. In medium-level systems, windrows are turned a minimum of four times per year to control oxygen levels and temperature, and to hasten decomposition. After the decomposition process, windrows are often formed into curing piles until the microbial activity slows down to the point at which the compost is deemed stable. An end product, suitable for landscaping and gardening purposes, is complete in less than 1 year, and often in 4 to 8 months. Five of the communities that utilized a medium processing technology sold their

compost. For example, Cape May County, New Jersey sells its compost for \$7 per cubic yard. West Linn, Oregon earned \$16,000 in 1989 from the sale of compost products, which it sells to residents for \$5 per cubic yard or \$0.50 per 3-cubic-foot bag.

High-technology systems are utilized in three of the communities studied: Austin, Texas; Berkeley, California; and Naperville, Illinois. (Austin co-composts leaves and sewage sludge.) In higher-technology composting systems, windrows are turned frequently (e.g., once per week), internal windrow temperatures are monitored daily, and nutrients and/or water are added as needed to hasten decomposition. Higher-technology systems can handle more material per year than lower-technology systems on the same amount of land because the compost is complete in much less time. High- and medium-technology composting systems are often used in urban and suburban communities, where high volumes of yard debris combined with a shortage of space demand a time-efficient process. These systems offer an additional advantage for urban- and suburban-based composting sites, which are often located near populated areas; the more frequent turning aerates windrows and reduces odor problems.

Both medium- and high-technology composting systems can produce higher-quality mulch and compost end products that are more readily marketable. Two of the three cities with high-technology systems, Austin and Berkeley, sell their finished compost, while five of the communities with medium levels of technology give the finished product away for free. Austin sells its compost end product under the trade name "Dillo Dirt." The Wastewater Treatment Department received \$12,000 in 1990 from the sale of compost products.

Finished compost can also be utilized by the municipality. A number of public works departments use mulch and finished compost in parks and recreation areas, and alongside highways. An estimated 80 percent of Newark, New Jersey's compost is distributed to 266 community gardens and 540 backyard gardens through Rutgers University's Urban Gardening Program. A small amount of Newark's compost is sold to private businesses for \$2 per cubic yard.

Landfill cover represents a lower-value use for finished compost, as practiced in several communities. In 1991 Bowdoinham, Maine began to

Table 4.3
Compost Site Characteristics

Community	Public/ Private Compost Site	Mulching/ Composting Operation (a)	Technology (b)	Reject Rate (% by wt.) (c)	Regional or Local Site (d)	Compost Site Tipping Fee for Residential/ Public Sector (\$/ton) (e)
Austin, TX	Public	Windrow	Hi/Co-composting	<2%	Local	\$0
Berkeley, CA	Private	Windrow	High	<1%	Regional	\$25
Berlin Township, NJ	Public	Windrow	Med.	0%	Regional	\$0
Boulder, CO	Public	Mulched	Low	--	Local	--
Bowdoinham, ME	Public	Pile	Low	0%	Local	\$0
Columbia, MO	Public	Mulched	Low	NA	Local	\$0
Dakota County, MN	Public/Private (f)	Pile	Med.	<1%	Local	Varies
Fennimore, WI	Public	Windrow/Farms (g)	Med.	NA	Local	\$0
King Co., WA	Private	Varies	Varies	NA	Regional	\$25
La Crescent, MN	Public	Pile	Low	0%	Local	\$0
Lafayette, LA	Public	Windrow	Med.	<2%	Local	\$24
Lincoln, NE	Public	Mulched	Med.	NA	Local	\$0
Lincoln Park, NJ	Public	Windrow	Med.	NA	Regional	\$12.36/\$26.64
Mecklenburg Co., NC	Public	Mulched	Med.	NA	Local	\$0
Monroe, WI	Public	Pile	Low	NA	Local	\$0
Naperville, IL	Public	Windrow	High	<1%	Local	\$0
Newark, NJ	Public	Windrow	Med	NA	Local	\$0
Perkasie, PA	Public/Pvt	Windrow	Med.	NA	Local	\$0
Peterborough, NH	--	--	--	--	--	--
Philadelphia, PA	Public	Windrow	Med.	0%	Local	\$0
Portland, OR	Private	Varies	Varies	0.5%	Regional	Varies
Providence, RI	--	--	--	--	--	--
San Francisco, CA	--	--	--	--	--	--
Seattle, WA	Private	Windrow	Med.	<1%	Regional	\$5.47/\$18 (h)
Sonoma Co., CA	Private	Windrow	High	0%	Local	\$0
Takoma Park, MD	Public	Windrow/Pile	Med./Low	0%	Regional/Local	\$0
Upper Township, NJ	Public	Windrow	Med.	5%	Regional/Local	\$0
Wapakoneta, OH	Public	Farm	Low	--	Local	\$0
West Linn, OR	Public	Windrow	Med.	2%	Local	Leaves-NA, BR-\$12
West Palm Beach, FL (i)	Public	Mulched	--	26%	Regional	\$0

Key:

BR = Brush Med = Medium NA = Not Available Pvt = Private wt. = weight -- = Not Applicable

Notes:

- (a) Windrow -- Collected organic materials are placed in one or more rows for decomposition; Farm(s) -- Organic materials are tilled into or spread over fields at one or more local farms; Mulched -- Materials are ground and distributed without further processing; Pile -- Organic materials are placed into one or more large piles.
- (b) Low technology -- Materials are placed in piles or windrows (either screened or not) and turned up to four times per year. Materials take at least 1 year to compost. Medium technology -- Materials are often ground or shredded and sometimes watered before forming into windrows or piles. Windrows or piles are turned approximately four times per year, and compost is ready in 4 to 8 months.
- High technology -- Material is screened and/or watered before forming into windrows or piles. Additional nutrients can be added to speed the compost process. Temperature is measured frequently, and windrows or piles are turned with machines approximately once per week. The final product is screened and ready in 1 to 4 months.
- (c) The percentage of composted yard waste consisting of contaminants that require disposal.
- (d) Local sites service the municipality; regional sites service a number of jurisdictions.
- (e) Commercial businesses in Berlin Township, Bowdoinham, Fennimore, La Crescent, Mecklenburg County, Sonoma County, and Upper Township can use the composting sites free of charge. Commercial businesses in Berkeley pay \$25 per ton, in West Linn businesses pay \$12 per ton for brush, and businesses in Dakota County pay fees ranging from \$3.50 per cubic yard for loose yard waste to \$5.50 per cubic yard for bagged yard debris.
- (f) Dakota County owns two compost sites that are privately operated. Three additional sites are privately owned and operated.
- (g) Yard waste brought by residents to the drop-off site is windrowed; leaves collected at curbside are spread on local farms.
- (h) Seattle's contract fee at the Cedar Groves Compost Facility covered the first 24,000 tons only; the City was charged an \$18 per ton tipping fee for tons delivered above 24,000. The contract was renegotiated in 1992.
- (i) Palm Beach County's Solid Waste Authority (SWA) charges the City of West Palm Beach a tipping fee of \$37 per ton for yard waste dropped off at its sludge co-composting facility, which began operations in October 1991. The data given above are for the SWA's 5-acre mulch site at the North County Landfill.

compost food scraps, mixed waste paper, and other organic scraps. The finished compost is used as landfill cover, saving the Town between \$8 and \$10 per cubic yard for new cover material. When its landfill closes in 1992 the compost will be used as a final cover. Lincoln, Nebraska also uses its compost as a fill to help close the old landfill.

Some communities, such as West Palm Beach, Florida, Mecklenburg County, North Carolina, and Columbia, Missouri, mulch yard materials, particularly wood waste and brush, in lieu of more time- and land-intensive composting. Mulch can be used for landscaping purposes, to retain moisture in soil, and to control the growth of weeds. Mecklenburg County sells mulch produced from leaves, grass clippings, and small brush to the general public for \$6 per cubic yard, and compost for \$10 per cubic yard. Cape May County, New Jersey sells a mulch product for \$10 per cubic yard. Some mulch is also used as a landfill cover. Palm Beach County uses mulch for landfill management including erosion control and landscaping.

Yard debris materials can also be used without being composted, mulched, or shredded. Cape May County dug an 8-foot "Hibernaculum" trench for large brush and stumps to be used as a wildlife habitat. The process will be repeated in an estimated 7 to 10 years, when these materials have decomposed. Boulder, Colorado and Columbia, Missouri sank Christmas trees in lakes to improve fish habitat. In Lafayette, Louisiana, trees were used as wave barriers and sediment traps to prevent coastal erosion.

How Do Communities Increase Composting Levels?

Charts 4.1 and 4.2 show the importance of composting in reaching a high level of materials recovery. The four communities recovering at least 50 percent of their municipal waste—Lincoln Park, Berlin Township, Bowdoinham, and West Linn—are composting between 11 and 30 percent of their municipal waste.⁷ Since yard debris is often a larger component of the residential waste stream than of the commercial and institutional waste streams, yard debris composting has an even more pronounced effect on residential recovery levels. For example, Fennimore, Wisconsin composted 13 percent of its municipal waste stream but 26

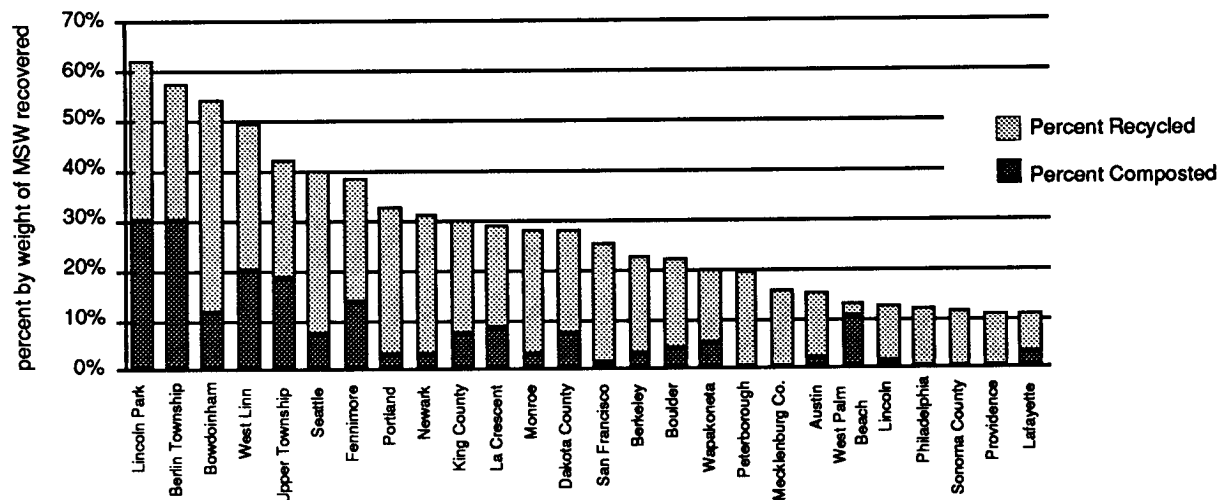
Table 4.4
Compost/Mulch End Products

Community	Compost or Mulch End Product	Compost or Mulch End User	Sale Price (\$)
Austin, TX	Compost	Landscapers, Retailers	Marketed through garden shops as "Dillo Dirt"
Berkeley, CA	Compost, Mulch	Wholesalers, Nurseries, Businesses, Residents	\$7 - \$15/cy
Berlin Township, NJ	Compost	Residents	\$0
Boulder, CO	Mulch	Residents, Public Facilities	\$0
Bowdoinham, ME	Compost	Residents	\$0
Columbia, MO	Mulch, Wildlife Habitat	Residents, Landscapers	\$0
Dakota County, MN	Compost, Mulch	Residents, Landscapers	\$0 to \$8/cy
Fennimore, WI	Compost, Farm Application	Farmers	Not sold, used in City
King Co., WA	Compost, Mulch	Privately marketed	NA
La Crescent, MN	Compost	Residents	\$0
Lafayette, LA	Compost for Public Facilities	Public Facilities	Not sold
Lincoln, NE	Compost for Landfill, Mulch	Landfill, Landscapers	Mulch \$3-\$8 /cy
Lincoln Park, NJ	Compost, Mulch	NA	NA
Mecklenburg Co., NC	Compost, Mulch	Residents, Landscapers	Compost \$10/cy, Mulch \$4-\$6/cy
Monroe, WI	Compost	Residents, Public Facilities	\$0
Naperville, IL	Compost, Mulch	NA	\$0 for Mulch
Newark, NJ	Compost, Mulch	Rutgers U. Urban Gardening, Businesses	Compost: \$0 for residents, \$2/cy for businesses
Parkside, PA	Farm Application, Mulch	Landscapers, Farm	\$0
Peterborough, NH	--	--	--
Philadelphia, PA	Compost, Mulch	Residents, Landscapers, Community Gardens	\$0
Portland, OR	Compost, Mulch	Residents, Landscapers, Nurseries	Varies; \$10/cy for food waste compost
Providence, RI	--	--	--
San Francisco, CA	Compost, Mulch	Retail and Residents	Compost "Zoo Doo" NA, Mulch \$0
Seattle, WA	Compost	Retail and Wholesale Outlets	\$6/cy (wholesale), \$3/cubic-foot bag (retail)
Sonoma Co., CA	Compost	Landscapers, Farmers, Residents	\$15-\$25/cy
Takoma Park, MD	Compost, Mulch	Residents, Garden Shops	\$0
Upper Township, NJ	Compost, Mulch, Wildlife Habitat	County, Residents	Compost \$7/cy, Mulch \$10/cy
Wapakoneta, OH	Farm Application	Residents, Farmers	\$0
West Linn, OR	Compost, Mulch	Residents, Public Facilities	\$5/cy or \$3/3 cubic-feet
West Palm Beach, FL	Mulch	Residents (Mulch), Landscaping at Landfill	\$0

Key:

cy = cubic yard NA = Not Available -- = not applicable

Chart 4.1
Percent of Municipal Solid Waste Recovered



Notes: Total waste recovery level is utilized for Austin, Newark, and Upper Township. In 1990 Columbia did not track yard debris tonnages mulched. MSW recovery rates are not available for Naperville, Perkasie, and Takoma Park.

percent of its residential waste stream in 1990. Communities with extensive landscaping, mature deciduous trees, and spacious yards generally have the potential to reach higher composting levels than other communities.

The following activities have proven successful in enabling communities to divert large portions of their waste through composting

- provide frequent curbside collection of yard debris for composting;
- target all residential buildings for yard debris collection;
- promote and encourage backyard composting and “don’t bag it” programs;
- offer collection of a variety of yard debris materials;
- start pilot programs collecting food discards for composting;
- increase residential, commercial, and institutional participation (strategies include mandates and economic incentives); and
- encourage landscapers and businesses to compost.

Frequent and Convenient Collection

The frequency of yard debris pick-up affects the level of participation and consequently the level of composting. Setting out yard trimmings for composting needs to be as convenient for residents as setting out their refuse. Weekly year-round curbside collection of organic waste for composting has proven effective in reaching high recovery levels in Berlin Township, Takoma Park, West Palm Beach, and Lafayette. Until June 1990, Takoma Park collected leaves during the fall months only. When it added year-round collection of leaves and grass clippings to its seasonal fall leaf collection program, the percentage of residential waste composted increased from 18 percent in 1990 to 24 percent in 1991.

Communities recovering large amounts of yard debris have collection programs that mirror yard debris generation patterns. In Southern cities, such as West Palm Beach and Lafayette, year-round collection is essential to reach high composting levels. Lafayette implemented a year-round, weekly collection program in May 1990 for leaves, grass clippings, branches, and brush. The program

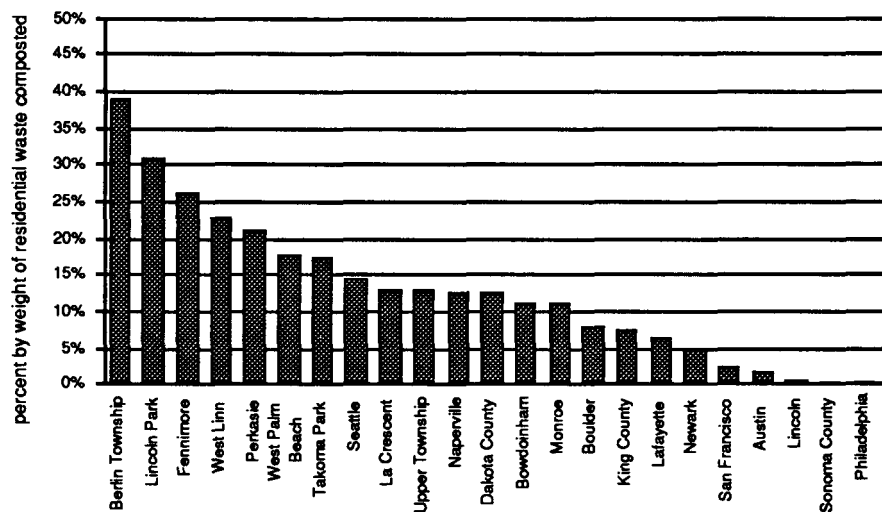
was so effective that during the first year of its operation, the City composted 18 percent of its residential waste.⁸ West Palm Beach recovered 18 percent of its residential waste from April 1990 to March 1991 through year-round, twice monthly yard debris collection. In fiscal year 1989, Mecklenburg County collected an estimated 1,176 tons of yard debris at its drop-off site. Charlotte, which has 80 percent of the County's population, implemented a weekly, year-round curbside program in January 1991. With the addition of this program, the County recovered 15,881 tons of yard debris during the first 6 months of 1991—almost 14 times the amount collected in 1989.

In northern climates, frequent seasonal collection can be an effective alternative to year-round collection. Naperville, Illinois composted 13 percent of its residential waste in 1990 through weekly collection of grass clippings and garden trimmings 8 months of the year. The City collected leaves and brush during three seasons, an average of three times each season. Lincoln Park composted 30 percent of its municipal waste in 1990 through mandatory curbside collection of leaves, brush, and grass clippings, at least twice per month, in the spring and fall. The Borough augments seasonal collection with a drop-off site at the recycling center that accepts yard materials year-round. Sixty percent of all residential material composted in 1990 was collected at curbside; the remainder was accepted at the drop-off site. In contrast, the City of Philadelphia, which collects leaves only once per year in the neighborhoods considered to have the highest tree density, composted less than 1 percent of its residential waste in fiscal year 1990.

Target All Residential Buildings for Yard Materials Collection

The three communities collecting yard debris at curbside from 100 percent of their households—Fennimore, Upper Township, and Berlin Township—composted between 13 and 39 percent of their residential waste.⁹ The four municipalities targeting the lowest percentage of their total households with curbside pick-up, Berkeley (6 percent served), Philadelphia (7 percent served), Sonoma County (1 percent served), and Lincoln (3 percent served), are among the communities with the lowest composting rates. Santa Rosa is the sole city providing curbside yard debris collection in Sonoma County. However, the pilot curbside program provides service to only 1 percent of Santa Rosa's population. The City collected 50 tons of leaves and 33 tons of wood waste in 1990, less than 1 percent of residential materials recovered.

Chart 4.2
Percent of Residential Waste Composted



Notes: Bowdoinham's composting level is based on its municipal solid waste, which is largely residential. Lafayette's 6% composting level is based on the program's first 5 months of operation. After the first 11 months the City composted 18% of its residential waste. For Upper Township, Newark, and Philadelphia, composting levels represent that portion of the waste handled by the public sector. For these communities, compost tonnage thus may include some commercial waste, and exclude residential waste handled by the private sector.

Target a Wide Range of Materials for Collection

Communities collecting more types of organic waste for recovery generally have higher composting levels. The seven communities composting at least 15 percent of their residential waste stream composted at least three different types of organic materials. Of the 12 communities composting more than 10 percent of their residential waste stream, 9 collect grass clippings at curbside. Berlin Township composted 30 percent of its municipal waste in 1990 and collected five types of organic materials—leaves, grass clippings, brush, wood waste, and Christmas trees—year-round at curbside. Austin, which collected only one type of organic waste at curbside, composted only 2 percent of its residential waste. Table 4.1 specifies the types of organic materials collected.

Berlin Township composted 30 percent of its municipal waste in 1990 and collected five types of organic waste—leaves, grass clippings, brush, wood waste, and Christmas trees—year-round at curbside.

Problems can arise as communities expand the number of materials targeted. For example, in response to a statewide yard debris ban, Naperville, Illinois began to collect and compost grass clippings, leaves, and brush. However, the City received some complaints from residents near the compost site about odor problems, which had developed due to composting an unbalanced ratio of grass clippings, leaves, and brush. Because grass clippings are high in nitrogen, they decompose at a faster rate than other yard trimmings. Odor can be avoided by providing an adequate supply of oxygen and a higher percentage of leaves, which are high in carbon. (Leaves collected in high-volume months, can be reserved to compost with grass clippings generated primarily in spring and summer.) In addition, “grasscycling” and backyard composting programs can obviate the need for large-scale composting of grass clippings. (See Chapter 3 for more information on these programs.)

Communities without accessible markets for mixed paper can compost these materials. Bowdoinham residents separate mixed paper such as junk mail, high-grade paper, paperboard, and paper towels from other recyclables. These materials are composted along with food discards at the landfill; the compost will be used as a landfill cover when the landfill closes in June 1992.

Composting Food Discards

Food discards constitute approximately 8 percent of municipal solid waste generated nationwide, and a larger percentage of residential waste. Some cities generate higher amounts. An estimated 31 percent of residential waste and 19 percent of commercial waste generated in San Francisco is food waste.

Recovery of food discards through composting can elevate waste diversion rates. Communities both within our sample and outside have diverted large amounts of food discards from disposal through composting programs. In addition, communities that encourage backyard composting of food scraps (excluding meat scraps and bones) or vermicomposting (the use of worms to digest and convert food waste into a fertilizer product), can reduce their waste collection and disposal costs and can increase recovery rates by reducing the amount of solid waste generated. Residents can be instructed in backyard or home composting techniques to ensure optimal compost processing and to avoid odor and vermin problems.

Backyard composting of food discards is practiced in rural, suburban, and urban communities. While cities such as Newark, New Jersey encourage backyard composting of food scraps, other cities such as San Francisco encourage vermicomposting. In 1990 San Francisco estimated that residents were composting 4,414 tons of food discards and 2,164 tons of yard materials at home, an amount equivalent to 6 percent of all material recovered from the residential sector that year. (See Chapter 3 for a discussion of backyard composting programs.)

Food discards can also be collected at curbside. Private New Jersey hog farmers collect food scraps from residents in Philadelphia and Kodiak Recycling collects food scraps from residents in

Peterborough for recovery as animal feed. In 1990 Sunflower Recycling Inc., a private hauler in Portland, Oregon, collected and composted food scraps from 105 City households. Sunflower provided residents with used 5-gallon paint or soap buckets free of charge, and charged residents an additional \$2 for collecting the food scraps. Food scraps, including bones and fat, were collected in a separate side bin on a refuse hauling packer truck. To process the material, Sunflower mixed food scraps with sawdust (in a ratio of 2:1) in two 7-cubic-yard retrofitted cement mixers. The food waste could be finished in 2 to 3 weeks; however workers tended not to turn the material frequently, so the composting process took 2 months on average. The finished compost was sold at \$10 per cubic yard. Sunflower collected an estimated 5 tons of food scraps per month in 1990.

Food waste can also be collected at curbside. Private New Jersey hog farmers collect food waste from residents in Philadelphia and Kodiak Recycling collects food waste from residents in Peterborough for recovery as animal feed.

The Town of Bowdoinham composted food scraps collected from a local college cafeteria with either mixed waste paper or leaves from the Town, in order to compare the resulting finished composts. Although the Town no longer composts food scraps from the college, Bowdoinham composts food scraps dropped off by residents each Saturday at the Town's Recycling Barn.

King County, Washington, including Seattle, is actively pursuing new ways to recover food discards. In FY 1992 the County allocated \$800,000 to research the potential for food scrap composting. King County collected and composted food scraps generated during its 1990 County Fair in order to determine whether a consistent compost could be produced and whether it was feasible to compost food scraps on a large scale.

See side bars "New York's Park Slope Neighborhood Intensive Recycling Project" and

"Lessons from Abroad" for additional discussion of food waste recovery programs.

Legislative Mandates and Economic Incentives

Communities have implemented economic and legislative incentives to encourage residents and businesses to source-separate organic materials, and to encourage haulers to collect them for recovery. Of the eleven communities with composting rates of at least 7 percent, three (Berlin Township, Lincoln Park, and Fennimore) require residents to participate in source-separation programs, six (West Linn, Bowdoinham, La Crescent, Dakota County, Perkasee, and King County) charge volume-based refuse rates, and Seattle has both variable refuse rates and requires the source-separation of yard debris. West Linn and Dakota County require haulers to collect source-separated yard debris from their refuse customers. (See side bar on Dakota County's User Fee Schedule.) West Palm Beach alone among the top eleven has a voluntary program without volume-based rates. West Palm Beach can attribute its high composting rate to twice monthly, year-round curbside collection of yard trimmings from 75 percent of its residents.

Volume-based refuse rates are at the heart of West Linn's successful composting program. In cooperation with the City, the private refuse and recycling hauler charges less for the collection of source-separated leaves and brush than for the collection of refuse. In order to avoid the fee for curbside collection of refuse and yard debris, many residents choose instead to compost yard debris in their yards (an estimated 15 to 20 percent of all yard debris was composted in yards in 1990) or to deliver materials to the composting site. Leaves, grass clippings, brush, and wood waste are accepted at the drop-off site for a lower fee than that charged by the private hauler for curbside pick-up. In 1990 West Linn composted 20 percent of its municipal waste (excluding backyard composted tonnages), primarily through drop-off collection.

King County, Washington has developed several types of drop-off collection programs for areas not serviced with curbside collection of yard materials. The County's experience with its mobile

Lessons from Abroad

Information generated from a number of European communities provide well-tested models for U.S. food scrap composting programs. Due to problems marketing finished MSW compost, many European cities are now targeting collection and composting of segregated "blowaste" (yard debris and food discards and sometimes soiled waste paper). In 1988 at least 71 source-separation projects were operating in West Germany. Approximately 430,000 households, which composted an estimated 200 pounds per person per year, were served by these projects. The largest program, in Heidelberg, serviced over 100,000 residents.

Residents of single- and multi-family households in some cities in the Netherlands keep food and yard materials segregated from refuse by placing these organic materials in bins ranging in size from 10 to 140 liters. Two workers operate automated collection compactor vehicles, which empty two containers simultaneously into the trucks. The average loading time for the two containers is 24 seconds. Refuse is either co-collected with food and yard materials in compartmentalized vehicles or collected on alternating days. A "bio bin" system developed in Germany recovers organic yard and food materials only, using an automated two-bin collection system for organic wastes and refuse. Most residents take recyclables to local drop-off sites.

Following the lead of Europe, cities in Canada are beginning to initiate extensive organic material recovery programs. The metropolitan Toronto area located in Ontario, Canada, initiated a 12-month wet waste pilot project in November 1991. Approximately 1,500 households in Toronto receive separate collection for recyclables, food and yard materials, and refuse. Separation of the wet waste is expected to reduce household waste 30 percent by weight in addition to the 15 percent being diverted through the recycling program.

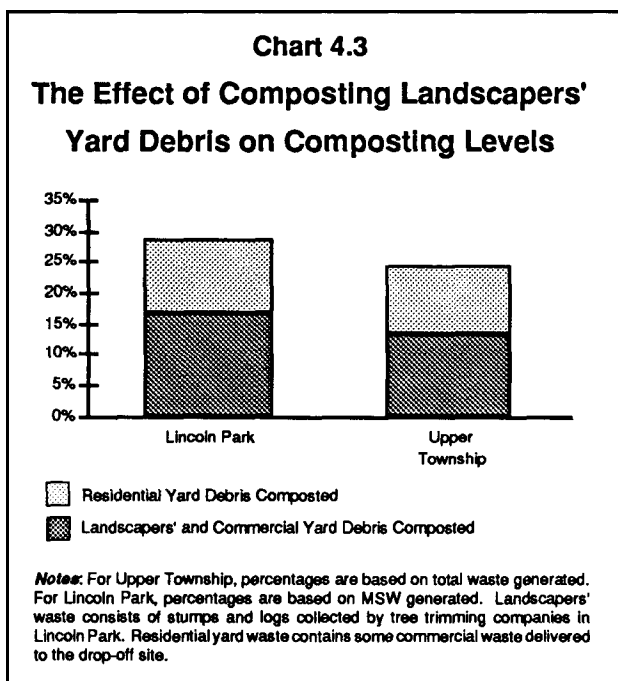
Guelph, Ontario implemented a pilot wet and dry recovery program. Residents place all wet material (including food scraps, yard debris, soiled paper, and disposable diapers) in one container and dry recyclables and waste in a second. Wet materials are composted, while dry recyclables are sorted and marketed. Participation rates have been extremely high (99 percent), and these systems have recovered between 83 and 96 percent by weight of all organic materials. Guelph has expanded its wet and dry program, and will service all City households by the end of 1993. (See Chapter 5 and Appendix E for further information on wet and dry recovery systems and their costs.)

Sources: Office of Technology Assessment, *Facing America's Trash: What's Next for Municipal Solid Waste* (Washington, D.C.: U.S. Government Printing Office, October 1989), 188-189; Anne Scheinberg et al., "European Food Waste Collection and Composting Programs," *Resource Recycling*, December 1990; and "Wet Waste Collection Pilot Launched by Metro," *BioCycle*, December 1990.

drop-off depots, which rotate to different sites, emphasizes the importance of convenience and financial incentives for maximizing residents' participation in such programs. Drop-boxes—located at refuse disposal sites—serve rural areas, while a mobile yard debris collection program serves certain suburban and urban locations. In 1989, the first year of the program, residents could deliver yard debris for free one week per month at one of five mobile drop-off depots. Over a 6-month period that year, King County recovered a total of 2,801 tons of material at five mobile units (an average of 560 tons per unit). In 1990 the

County instituted a \$5.25 per cubic yard tipping fee (estimated at \$42 per ton¹⁰)—almost as much as the refuse tipping fee of \$47 per ton—reduced service at its mobile units from one week to one weekend per month, and cut back from five mobile units to four. During a 6-month period in 1990, the County recovered only 683 tons (an average of 171 tons per mobile drop-off unit), almost 76 percent less than in the 6-month period the previous year.¹¹

Yard debris disposal bans can lead to high composting recovery rates. By February 1992, 15 states, plus the District of Columbia, had enacted yard waste bans. (Connecticut, New Jersey and



Pennsylvania ban leaves only.)¹² These bans have proven extremely effective in spurring the implementation of yard debris collection and composting programs.

In April 1990, for example, Naperville implemented weekly collection of garden trimmings and grass clippings in response to Illinois' yard debris landfill ban, which became effective in June of that year. In 1992, in order to encourage residents to compost at home and thus reduce collection and processing fees, Naperville began charging residents \$1.50 per bag of yard debris set out.

Encouraging Businesses and Landscapers to Compost

In some communities, yard materials generated by business establishments and professional landscapers constitutes a substantial portion of total yard

debris generated. By allowing private haulers to deliver their yard materials to drop-off sites for free or at reduced tipping fees, communities can attract haulers to composting sites and greatly increase composting levels. Chart 4.3 indicates the contribution of landscapers' waste to overall composting levels in Upper Township and Lincoln Park, New Jersey. Cape May County, in which Upper Township is located, allows businesses and residents to drop off leaves and grass clippings free of charge at the County-owned and -operated composting site. Lincoln Park recovered 1,876 tons of stumps and logs-equivalent to 12 percent of the MSW generated by the Borough—from tree trimming companies in 1990. These companies could drop off materials free of charge. Seattle's two transfer stations accept yard debris, including leaves and brush up to 12 inches in length, from residents and businesses at reduced tipping fees. Through this program, Seattle composted 15 percent of all waste self-hauled to disposal sites.¹³

In Dakota County, Minnesota, residents, landscapers, and haulers can drop off leaves, grass clippings, garden trimmings, and prunings up to 6 inches in diameter at one of the five compost sites in the County year-round. They pay a lower tipping fee at the composting site than at the landfill. In 1990 residents and landscapers dropped off 2,489 tons of yard materials at County sites,

User Fee Schedule Helps Dakota County, Minnesota Receive Loose Yard Debris

In order to encourage private haulers, landscapers, and residents to deliver loose rather than bagged yard debris to its three composting sites (to reduce compost processing labor and operating costs), Dakota County has implemented a sliding-scale tip fee, which it calls its User Fee Schedule:

User	Loose Yard Debris	Bagged Yard Debris
Haulers	\$3.50/cubic yard	\$5.50/cubic yard
Landscapers	\$3.75/cubic yard	\$5.50/cubic yard
	\$3.00/cubic yard of brush	
Residents	\$3.75/cubic yard	\$0.15/bag
	\$2.00/cubic yard of brush	

In 1990 Dakota County composted 16,602 tons of yard debris, equivalent to 58 percent of the yard debris generated.

New York City's Intensive Recycling Project

New York City is currently conducting an intensive recycling pilot project in which a wide range of materials, including food scraps, is collected for recovery from 3,500 households in Park Slope, Brooklyn. Residents participating in the Park Slope recycling project are instructed to place all food waste in cellophane-lined paper bags distributed by the City. Each multi-unit building is provided with a sealed plastic bucket in which residents place bags of food scraps at their convenience. (One- to three-unit buildings are provided with 8-gallon buckets; buildings with more than three units are provided 20-gallon buckets.) The City collects materials weekly in a 25-cubic-yard rear-end packer and composts the food and paper bags on 1 acre of land, located on a 40-acre composting site at the Fresh Kills Landfill. Leaves and wood chips are added as bulking agents. Materials were initially combined in a ratio of 3 parts leaves to 1 part food, but to reduce odors, the ratio was changed to 5 to 1.

By March 1992, 5 months into the food waste pilot, the City was collecting an average of 4.1 tons of food scraps per week from the 3,500 households. Food waste collection has been proceeding smoothly, with no complaints from residents about odor or vermin problems. (The City will continue to monitor this situation over the summer months.) Food waste comprises 13 percent of the waste generated in the pilot area; of this, the City estimates that it is capturing 41 percent. (The overall waste recovery rate in the intensive recycling district is estimated at 35 percent.) The material delivered to the site is relatively uncontaminated, probably due to the size of food waste bags (they are too small to hold other refuse) and the prominent instructions that appear in both English and Spanish on the side of the bags. Community volunteers encourage participation through the distribution of leaflets and in-person education. However, in some instances residents have run out of bags at a faster pace than anticipated, and some buildings have found their central containers to have inadequate capacity.

Source: Tom Outerbridge (Recycling Programs and Planning Division, The City of New York Department of Sanitation), personal communication, January to April 1992.

representing 4 percent of MSW recovered and 15 percent of the total materials composted in the County that year.

Since October 1990, Lincoln, Nebraska has allowed residents and landscapers to drop off brush and other yard materials at its transfer station for \$4 per pick-up load. Although the City only composted 1 percent of its MSW in 1990, 80 percent of this amount was yard debris self-hauled to the transfer station.

In some communities, nonprofit organizations and community groups operate composting sites that accept commercially generated materials. In Austin, Texas, residents and landscapers can bring leaves and grass clippings year-round to a 6-acre compost site operated by Austin Community

Gardens, a nonprofit horticultural organization. Residents drop off material free of charge, while landscapers pay a \$35 annual fee. In 1989 landscapers contributed an estimated one-half of the materials composted that year. The compost is applied to the 23 public gardens operated by Austin Community Gardens. In 1989 this organization composted 5,628 tons of yard debris-67 percent of total yard debris recovered in Austin.

Conclusion

By integrating the best features of the best composting programs listed above, communities can divert a significant percentage of their waste from disposal while producing a valuable and marketable

soil amendment. Because yard and food materials constitute a significant portion of the municipal waste stream, communities need to target these

organic fractions of both the residential and commercial waste streams in order to maximize recovery.

Notes

¹This report examines source separation of yard debris and food scrap composting only. It does not provide an overview or an assessment of mixed MSW or sludge composting.

²In many cases, communities do not weigh yard materials, but rather convert volume to weight using local, regional, or national conversion factors. See Appendix C for sample conversion factors.

³In contrast, Portland, Oregon, which opened its *mixed* municipal solid waste (MSW) composting facility in April 1991, has yet to produce a marketable end product. At the end of January 1992, Portland's composting facility, the nation's largest operating MSW composting system, stopped accepting garbage due to persistent odor problems. Tests have shown lead content in the end product exceeding the acceptable standard of 250 parts per million.

⁴Lori Segall and Ron Smith, "Raking Versus Bagging," *BioCycle*, September 1989, 44-45.

⁵West Palm Beach's 18 percent residential composting level excludes the 4,299 tons of contaminated yard debris, which were disposed.

⁶In Portland Oregon, for example, yard trimmings were composted in a pile measuring over 100 feet in height at a private compost site, MacFarlene Bark. When the Oregon State Department of Environmental Quality received complaints about odor emanating from the pile, MacFarlene Bark resolved the problems by turning the pile more frequently. In 1991, the Town of Bowdoinham, Maine, began to compost fish waste from a local cannery along with other organic waste. Although fish waste gives off a strong odor, this reportedly does not create a problem since the compost site is located 6 miles from the Town.

⁷Except for San Francisco, composted tonnages do not include tonnages recovered through backyard composting or "grasscycling" programs.

⁸The City composted 5,760 tons over the 11-month period from May 1990 to April 1991, or 523 tons per month. If monthly residential waste generation remained unchanged from 1990 to 1991, Lafayette composted 18 percent of its residential waste. The 6 percent residential composting figure for Lafayette in Charts 4.1 and 4.2 is based on tonnage figures from November 1989 through October 1990.

⁹While Wapakoneta collects leaves from all its households, it does not track residential recovery rates and, up until June 1990, it burned a significant portion of its yard debris.

¹⁰The tipping fee for mixed yard debris was converted from volume to weight using a conversion factor of 250 lbs. per cubic yard. (*Regional Yard Debris Recycling Plan*, Portland, Oregon, December 1990.)

¹¹From May to October 1989, the County recovered 2,801 tons of yard debris at its five mobile units; from June to November 1990, after program tipping fees were instituted and service reduced, the County recovered only 683 tons of yard debris through four drop-off units. The County has implemented curbside collection in some unincorporated areas and has consequently discontinued its mobile service.

¹²George Brabec, "The First Statewide Yard Waste Ban: Meeting the Challenge," *Resource Recycling*, February 1992, 69-74.

¹³The self-haul waste stream includes recyclable materials and waste brought to the City's transfer station by residents and businesses.